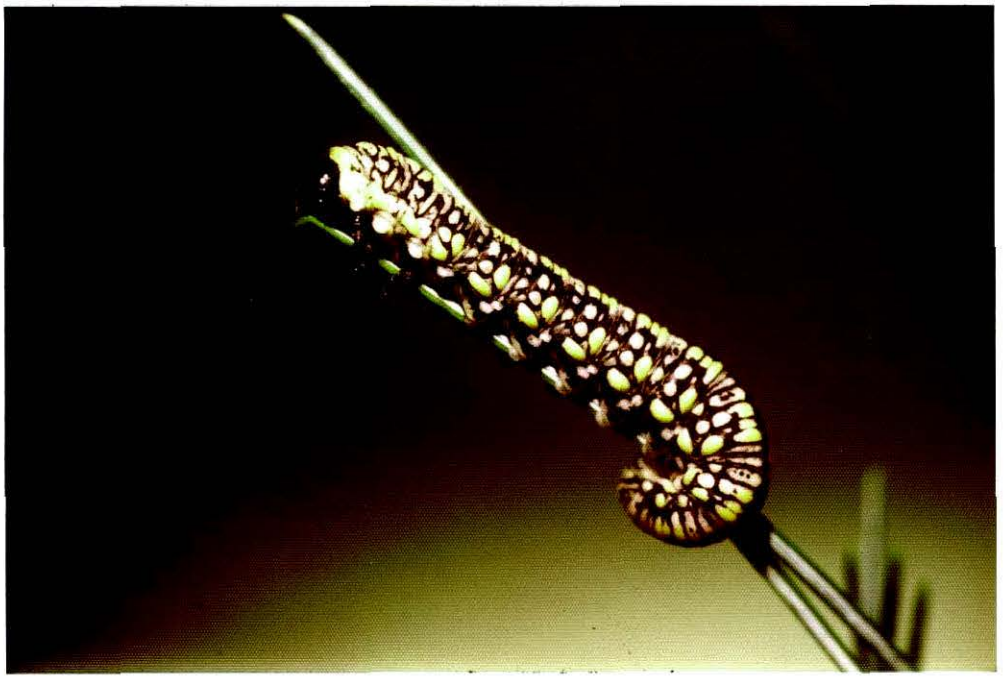
Forest Insect & Disease Management

Report No. 79-1-9
March 1979

BIOLOGICAL EVALUATION OF THE INTRODUCED PINE SAWFLY OUTBREAK
IN THE LINVILLE FALLS AREA OF THE BLUE RIDGE PARKWAY, NORTH CAROLINA
1979



SOUTHEASTERN AREA, STATE & PRIVATE FORESTRY
USDA FOREST SERVICE, ATLANTA, GA 30309

COVER PHOTOGRAPH

Late instar larva of the introduced pine sawfly, *Diprion similis* Htg.

BIOLOGICAL EVALUATION OF THE INTRODUCED PINE SAWFLY OUTBREAK IN THE LINVILLE FALLS AREA OF THE BLUE RIDGE PARKWAY, NORTH CAROLINA 1979

By

Patrick J. Barry, Supervisory Entomologist
William H. Hoffard, Entomologist
John H. Ghent, Entomologist

ABSTRACT

The introduced pine sawfly, Diprion similis Htg., was introduced into New England in 1914. In 1977, an infestation was discovered in the southern Appalachians, and the pest is now well established in North Carolina. Little is known of the potential of this pest in the Southeastern Area's conifer forest. The purpose of this evaluation is to assess this pest's aesthetic impact in scenic and recreation areas of the Blue Ridge Parkway.

INTRODUCTION

The introduced pine sawfly first appeared in New England in 1914, apparently having arrived on infested nursery stock. Since then, it has spread westward, being a problem mostly in the Midwest and Northeast. In 1977, an infestation was discovered in the southern Appalachians (Drooz, et al., 1979). In December 1978, a prepupal cocoon survey in selected white pine stands showed the pest to be scattered over approximately a 250 square mile area.

The establishment of the sawfly in the Southeast is a matter of serious concern. Its favored host (white pine) extends deeply into mountainous areas of Virginia, Kentucky, Tennessee, North Carolina, South Carolina and Georgia (Fig. 1). White pine forms a significant and economically important part of the forest type in these areas (Table 1 and Figure 2). The potential for damage to white pine Christmas tree

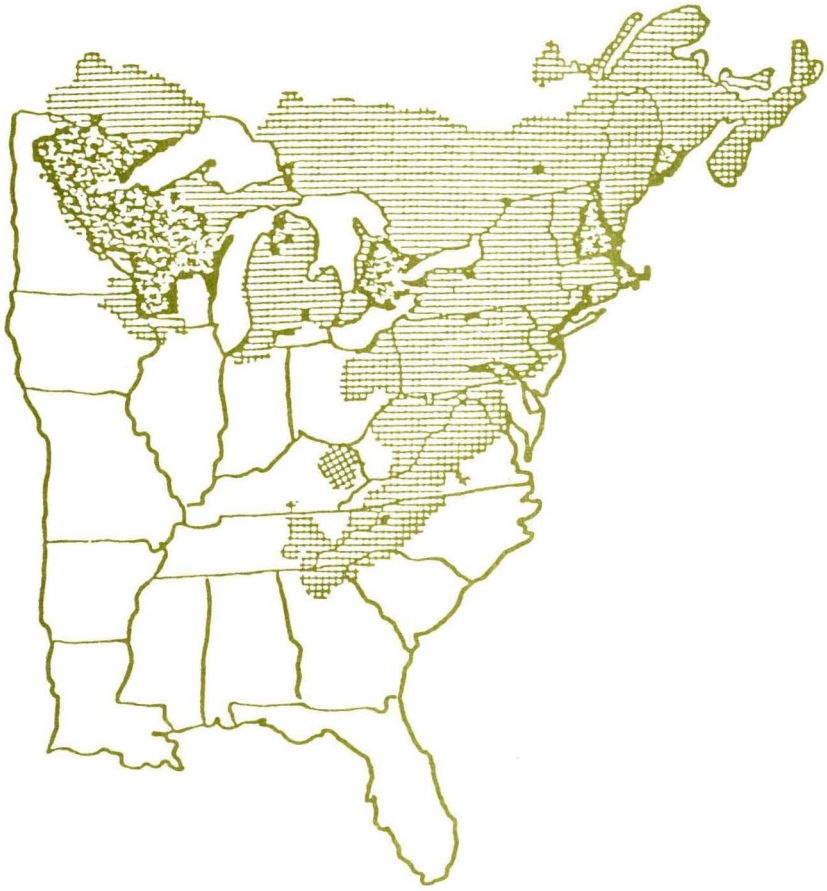


Figure 1. Range of eastern white pine (crosshatched) and introduced pine sawfly (solid) in eastern North America.

Table 1. Eastern white pine timber volume for the southeastern United States.

State	Growing Stock[1/] (thousand ft.^{3})	Sawtimber[2/] (thousand b.f.)
Georgia	152,900	704,500
Kentucky	9,340	31,510
North Carolina	421,945	1,761,520
South Carolina	18,100	64,000
Tennessee	151,100	622,300
Virginia	157,200	536,800

1/ Volume of all trees above 5 inches DBH.

2/ Volume of all trees suitable for board production (9 inches and above).

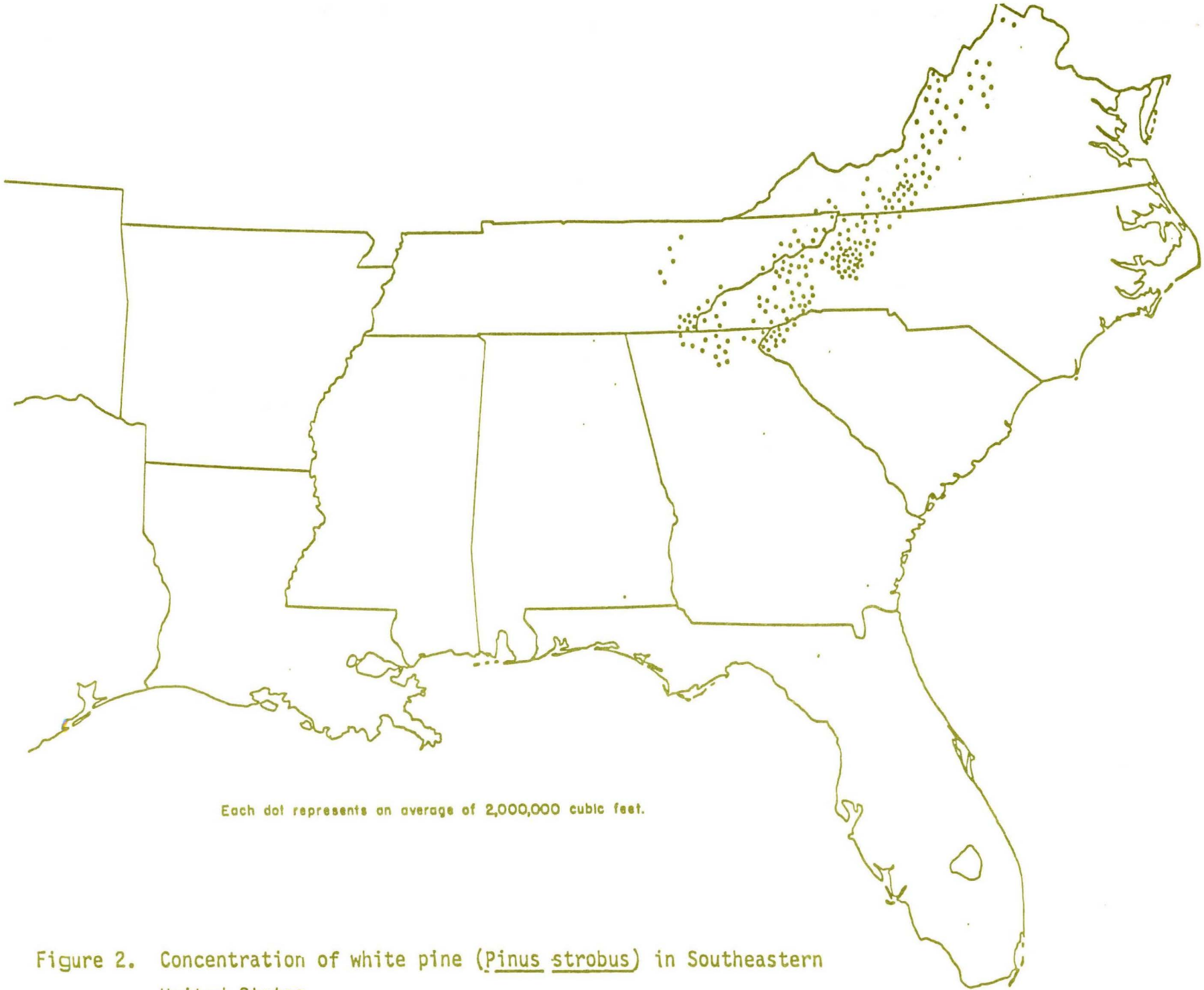


Figure 2. Concentration of white pine (Pinus strobus) in Southeastern United States.

plantations is also high. While there is a possibility that the population will collapse, such an occurrence is unlikely since such a newly-introduced insect with overlapping generations usually persists in outbreak status for several years.1/

The U. S. Department of Interior, Blue Ridge Parkway personnel are concerned with the possible loss of mature white pine in the Linville Falls portion of the Parkway. In this area, the Park Service has a high concentration of high-use recreational areas that include campgrounds, overlooks, and picnic areas. These areas shown in Figure 3 carry high priority for potential control.

A. Technical Information.

Insect.--Introduced pine sawfly - Diprion similis (Htg.)

Hosts.2/--Full-needled pine are favored but several two-needle species are also damaged. White, Scotch, red, jack and Austrian pines are attacked. White pine is clearly the most favored and most severely damaged.

Type of Damage.--Tree injury is caused by loss of needles. Young larvae can only strip needles causing them to dry and curl. Later instars consume whole needles. Heavy defoliation causes trees to fail to set buds. This results in top dieback and whole-tree mortality. Even if trees escape mortality, heavy defoliation causes significant growth loss (Wilson, 1966).

Life History.--After overwintering as prepupae, the sawflies pupate to emerge in the spring as adults. Since new adults of this generation emerge anywhere from April to June, there is often an overlap of life stages during the growing season. A disproportionate number of sawflies are males. This is becuase unmated females still produce fertile eggs which hatch into males. Very soon after emergence, the adults mate and eggs are laid in needles. In late May or early June, eggs hatch and the tiny caterpillars feed gregariously on the old needles. As the sawflies grow older, they become increasingly less gregarious until they are solitary feeders. In early July, the caterpillars form their cocoons. These can be found in bark cracks of the trees, among the host's needles, at branch bases, and sometimes among foliage of nonhost plants. Most adults emerge in early August and eggs are laid soon thereafter. Some of these adults do not emerge, but remain in their cocoons in a state of diapause for 1-3 years. Larvae of the second generation emerge in about a week, feeding until sometime in September. Unlike the first generation, most cocoons are spun in the leaf litter beneath the host. If weather

1/ Personal communication. Dr. Arnold Drooz, SEFES, Research Triangle, NC.

2/ All information presented on life history, host preference and control are based on northern United States studies.

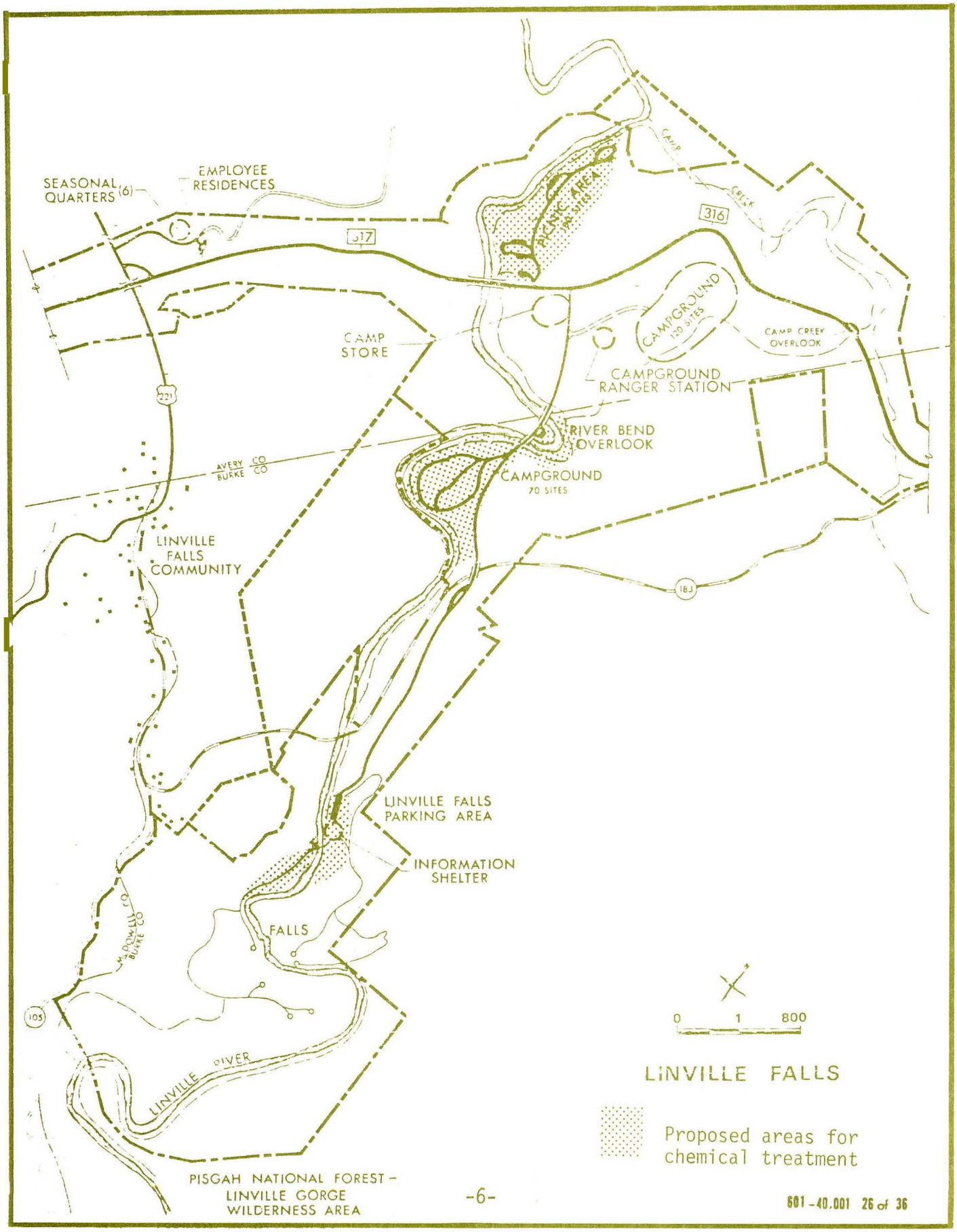


Figure 3. High-use areas with high priority for potential chemical control.

conditions are favorable, some of these insects pupate, emerge and bring forth a partial third generation which feeds until it succumbs to the cold.

B. Control.

Natural factors are apparently an important source of control. Perhaps chief among these in the Northeast is very low winter temperature which often destroys a large percentage of overwintering prepupae. Cocoons spun in higher bark cracks and in vegetation above the snowline are most vulnerable because they do not benefit from the snow's insulating effect.

Parasites are also an important means of control. The most important is a wasp (Monodontomerus dentipes) introduced from Europe. It is not known if this parasite is present in the Appalachian population. Mertins and Coppel (1968, 1971) and Hartley (1923) discuss parasites of the introduced pine sawfly found in Wisconsin and Pennsylvania, respectively.

Several insecticides are effective and approved by the EPA for both ground and aerial application. They may be used on Christmas trees as well as forest stands.

METHODS

A ground survey to delineate the extent of the infestation was conducted during December 1978 and January 1979. Transects were run through the white pine host type in the Linville, North Carolina, area. Foliage and bases of trees were carefully examined for pine sawfly prepupal cocoons. Stands in which cocoons were found were marked on topographic maps. This survey showed the pest to be scattered over approximately 250 square miles (160,000 acres) (Fig. 4). Hundreds of these prepupae were collected and a subsample of these was reared in January of 1979 and confirmed to be D. similis.

Cocoons from the 1978 infestation were also sampled for parasites during the gound survey. Examination of these cocoons showed a low occurrence of parasites in the population during the 1978 infestation.

Parasites of the sawfly cut a jagged edge around their exit hole as compared to the sawfly which cuts a smooth surface when emerging. During 1979, additional work will be done to determine the level of parasitism in the population as well as to identify the particular parasites.

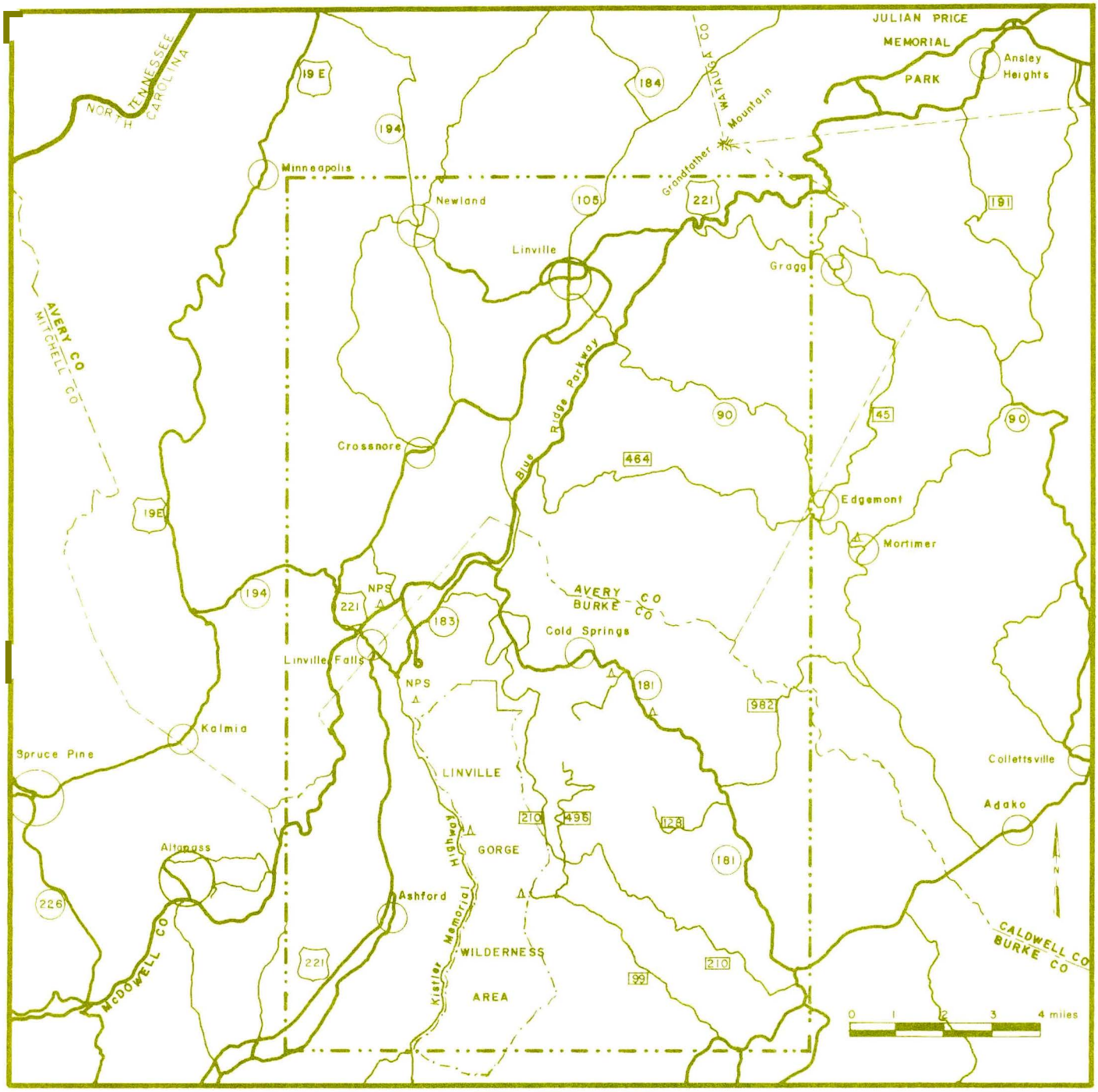


Figure 4. Dashed line indicates the extent of the Diprion similis infestation as determined by a prepupae cocoon survey, December 1978.

RESULTS AND DISCUSSION

Results of this evaluation and ground survey shows a high population of the sawfly in the white pine stands of the area. Cocoon exit (empty cocoon) holes indicate relatively low degree of parasitism from the 1978 infestation. This light parasitism rate is likely to persist through 1979, thus exerting little influence over the pest population.

Many of the trees in the scenic and recreation areas are old and of relatively low vigor. In addition to noxious problems caused by the sawfly in these areas (dropping larvae, fecal droppings, etc.), defoliation of old- and new-growth needles twice or more times during the growing season for the second year is likely to cause substantial dieback and mortality.

ALTERNATIVES

No Action

The outbreak would be allowed to run its course until brought under control by natural means such as virus, parasites, predators, and or weather.

The advantage to this alternative is that there would be no pesticide application with its secondary undesirable effects on non-target species.

Disadvantages to no action are loss of trees, cost of restoration, increased fire hazard, and adverse affects on aesthetic and recreation values. The area has trails, overlooks, camping and picnic areas which would become unattractive if the forest cover were removed by defoliation and loss of trees. Dead trees and dead tops would have to be removed to reduce hazards to users, thus increasing maintenance costs. Tree losses could approach 100 percent in the areas defoliated 3 to 4 consecutive years. Losses of 50 percent are conceivable during the second year of heavy defoliation in this particular situtation.

The nuisance caused by the effect of the presence of the insect itself and the droppings created by the insect would render the area undesirable to the public through the entire recreation season.

DIRECT SUPPRESSION

Delivery of pesticides to the target organism can be accomplished by ground or aerial application. Ground application involves the use of hydraulic sprayers, used in easily accessible areas. Aerial application in this area would involve a rotary-wing aircraft which, for economic reasons, would primarily be used on larger, less accessible acreages.

The advantage of using a chemical insecticide would be the elimination of the insect's larval stage. This will result in 1) protection of remaining second year and new foliage, 2) reduction in the severity of dieback and possible morality, 3) removal of the nuisance from high use areas, all of which aid in the protection of the initial investment of the high value area and the enhancement of the recreation experience.

The disadvantage for the use of the insecticide are the possible adverse effect these may have on the environment. Chemical may be deposited in streams, soil, vegetation and non-target organisms. Residue levels may increase in fish and wildlife in the area. However, through the use of a short-life insecticide, fitted to both control need and environmental consideration and with emphasis on proper planning and application, adverse affects can be minimized.

RECOMMENDATIONS

The results of this evaluation and survey indicate an increase in population densitites and subsequent defoliation in 1979. If no action is taken, heavy defoliation will cause top-kill and tree mortality. A suppression project is recommended in the spring of 1979 if forest recreation resource values and uses are to be maintained. Otherwise, the "do nothing" alternative is recommended.

PRECAUTIONARY PESTICIDE USE STATEMENT

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key -- out of the reach of children and animals -- away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your handsbecome contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary land-fill dump, or crush and bury them in a level, isolated place.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Department of Agriculture, consult your county agricultural agent or State Extension specialist to be sure the intended use is still registered.

REFERENCES

Drooz, A. T., C. A. Doggett, and H. C. Coppel, (in press). The introduced pine sawfly, a white pine defoliator new to North Carolina. USDA, Forest Serv. Research Note.

Hartley, E. A. 1923. Parasitism of the European pine sawfly Diprion similis Hartig (hymenopthera: Tenthredinidae) in Pennsylvania. J. Econ. Ent. 16: 386-388.

Jansen, P. L. and M. R. Weiland. 1960. Softwood distribution maps for the south. USDA, Forest Service. So. For. Exp. Sta., New Orleans, LA.

Mertins, J. W. and H. C. Coppel. 1971. Additions to the known parasitoid complex associated with Diprion similis (htg.) in Wisconsin.

Monro, H. A. V. 1935. Observations on the habits of the introduced pine sawfly, Diprion similis (Htg.). Can. Entomol. 67: 138-140.

Wilson, Louis, F. 1966. Introduced pine sawfly. USDA Forest Serv. Forest Pest Leaflet No. 99.